

REMARKS

The applicants appreciate the Examiner's thorough examination of the application and requests reexamination and reconsideration of the application in view of the following remarks.

The Examiner rejects claims 1-4, 7-8, 10-12, 16-18, 20-24 and 27-32 under 35 U.S.C. §103(a) as allegedly being obvious over U.S. Patent No. 6,041,642 to Duncan in view of U.S. Patent No. 6,106,149 to Smith.

The subject invention results from the realization that a truly effective sensor readout circuit can be achieved, not by sweeping the frequency response of a sensor, measuring the magnitude and phase shift at each chosen frequency, and then determining whether the chosen frequency represents the resonant frequency, but, instead by the combination of a unique phase detector circuit connected to an output and an input of a flexure plate wave sensor which detects the phase difference between the input and an output signal of the flexure plate wave sensor, and a drive circuit responsive to the phase detector circuit which maintains a fixed phase difference between the input signal and output signal to provide a continuous output of a frequency equal to the resonant frequency of the sensor.

Duncan shows a method and apparatus for measuring the natural resonant frequency of an element, and in particular a cantilevered body. Duncan does not disclose or suggest, however, a sensor readout circuit that includes a phase detector circuit responsive to an output signal from a flexure plate wave sensor and an input signal to the flexure plate wave sensor, as claimed by Applicants.

To overcome the deficiencies of Duncan, the Examiner combines it with Smith. Smith shows a mass and heat flow measurement sensor that uses a microresonator, which may be a flexure plate wave sensor.

However, one skilled in the art would not have motivation to combine Duncan with Smith since it is clear that a cantilever deflection system, such as that disclosed in Duncan, is markedly different from the flexure plate wave sensor of Smith. For example, whereas cantilevered spring element 10 of Duncan is supported at one end by fulcrum 16, a flexure plate wave sensor may include a membrane layer disposed over a silicon substrate which defines a cavity, as shown in U.S. Patent No. 6,688,158. A result of this difference is that a flexure plate wave sensor has a different range of applications than a sensor using a cantilevered body. Some of the applications for a flexure plate wave sensor include a sensor for a gas analyzer device capable of detecting the presence and concentration of hundreds of molecular components with less than one part per billion minimum detectable concentration sensitivity; a sensor for a liquid analyzing device capable of analyzing samples for several hundred possible contaminants or components simultaneously; or a sensor for a DNA sequencing device, as a virus/antibody detection device and for biological weapon detection. Thus, cantilever deflection systems and flexure plate wave sensors are not readily interchangeable devices.

Also, it would not have been obvious to one skilled in the art to combine the flexure plate wave sensor of Smith with the device of Duncan because frequency locking electronics such as that described in Duncan are not typically or readily configurable to flexure plate wave sensors.

Since Duncan does not teach, disclose or suggest a phase detector circuit responsive to both an output signal from and an input signal to a flexure plate wave sensor, but rather relates to sensing the natural frequency of a cantilevered spring element, it does not provide motivation to combine it with Smith which may use a flexure plate wave sensor. Therefore the combination of Duncan and Smith is clearly improper.

Furthermore, the Examiner offers an insufficient explanation of why there would be a

teaching, motivation, or suggestion to combine the teachings of Duncan and Smith in the first place. The Examiner states that "it would have been obvious for one of ordinary skill in the art to modify Duncan by adding flexure wave sensor disclosed by Smith for measuring mass changes by detecting resonant frequency changes." See the Office Action dated February 3, 2005, p. 3. However, neither Duncan, Smith or the prior art provides this suggestion to combine these references.

When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness. See, e.g., McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the Graham factors).

"The factual inquiry whether to combine references must be thorough and searching." Id. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc., 229 F.3d 1120, 1124-25, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting C.R. Bard, Inc., v. M3 Systems, Inc., 157 F.3d 1340, 1352, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998)); In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); In re Fine, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) ("teachings of references can be combined only if there is some suggestion or incentive to do so.") (emphasis in original) (quoting ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984)).

The need for specificity pervades this authority. See, e.g., In re Kotzab, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge

of the claimed invention, would have selected these components for combination in the manner claimed”); *In re Rouffet*, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) (“even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.”); *In re Fritch*, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992) (the examiner can satisfy the burden of showing obviousness of the combination “only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references”).

In re Sang Su Lee, 277 F. 3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002). Hence, there is no suggestion that Duncan’s apparatus for measuring the natural resonant frequency of a cantilevered body could be modified to use a flexure plate wave sensor, nor is there any suggestion that Smith’s mass and heat flow measurement sensor could be used with a phase detector circuit that maintains a fixed phase difference between the input signal and output signal. Neither reference teaches or suggests how a phase detector circuit of a sensor readout circuit could be configured to detect the phase difference between the input signal and the output signal of a flexure plate wave sensor or how a drive circuit could be configured to maintain a fixed phase difference between the input signal and the output signal of the flexure plate wave sensor. Only the applicants’ own disclosure teaches how a phase detector circuit and a drive circuit of a sensor readout circuit could be configured as such to function with a flexure plate wave sensor as claimed by Applicants, and it is improper to use the applicants’ disclosure as a blueprint for conducting a hindsight §103 analysis.

Claim 1 of the subject application recites: “A sensor readout circuit which provides a frequency signal output, the readout circuit comprising: a phase detector circuit responsive to an output signal from a flexure plate wave sensor and an input signal to the flexure plate wave

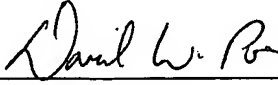
sensor and configured to detect the phase difference between the input signal and the output signal; a drive circuit responsive to the phase detector circuit and configured to maintain a fixed phase difference between the input signal and the output signal; and a processing circuit responsive to the output signal and configured to detect resonant frequency changes of the sensor due to mass changes to measure mass loading.” (Emphasis added.) Independent claims 17, 18, 20, 21, 31 and 32 each include similar features that distinguish over the proposed combination of Duncan and Smith. As noted above, neither Duncan or Smith provides motivation to combine it with the other. Therefore the combination of Duncan and Smith is improper.

The Examiner rejects claims 5-6, 9, 13-14, 19 and 25-26 under 35 U.S.C. §103(a) as allegedly being unpatentable over Duncan in view of Smith in further view of U.S. Patent No. 3,840,804 to Sauerland. Since each of these claims depends from one of independent claims 1, 17, 18, 20, 21, 31, or 32, they are patentable for at least the reasons stated above and are further patentable since they include one or more additional features.

Accordingly, the applicants respectfully request allowance of claims 1-14 and 16-32 since the combination of Duncan and Smith is clearly improper.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates collect in Waltham, Massachusetts, at (781) 890-5678.

Respectfully submitted,



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